Cost/Performance Ratio Achieved by Using a Commodity-Based Cluster

Commodity-based cluster "Aeroshark."

Researchers at the NASA Glenn Research Center acquired a commodity cluster based on Intel Corporation processors to compare its performance with a traditional UNIX cluster in the execution of aeropropulsion applications. Since the cost differential of the clusters was significant, a cost/performance ratio was calculated. After executing a propulsion application on both clusters, the researchers demonstrated a 9.4 cost/performance ratio in favor of the Intel-based cluster.

Within NASA's High Performance Computing and Communication (HPCC) program, Glenn is developing an environment for analyzing and designing propulsion engines called the Numerical Propulsion System Simulation (NPSS). NASA personnel are interested in computational simulations because of the potential for fielding improved air propulsion systems with lower development costs, greater fuel efficiency, and greater performance and reliability. One of the goals for NPSS is to create a "numerical test cell" enabling full engine simulations overnight on cost-effective computing platforms. In order to achieve this goal, NASA personnel at Glenn have been involved since the early 1990's in applying cluster-computing technology in solving aeropropulsion applications.

These researchers utilize the Aeroshark cluster as one of the primary testbeds for developing NPSS parallel application codes and system software. The Aero-shark cluster provides 64 Intel Pentium II 400-MHz processors, housed in 32 nodes. Recently, APNASA--a code developed by a Government/industry team for the design and analysis of turbomachinery systemswas used for a simulation on Glenn's Aeroshark cluster. APNASA has been used to evaluate new turbomachinery design concepts, from small compressors to large commercial aircraft engines. In this simulation, a single-stage fan was analyzed to determine the noise levels associated with three different rotor geometries based on takeoff (100 percent), cutback (87.5 percent), and approach (61.7 percent)

engine wheel speeds, each paired with three different vane geometries. This design matrix resulted in 9 (3 by 3) different configurations to be simulated in 24 CPU's.

After the application was executed on both the Aeroshark and on a Silicon Graphics Incorporated (SGI) Origin 2000 cluster, a performance factor of 2.36 was obtained in favor of the SGI. The cost of the SGI is 22.3 greater than that of the Intel-based cluster, therefore a cost/performance ratio of 9.4 in favor of the Aeroshark cluster was obtained.

Clearly, the commodity-based cluster has a tremendous potential for providing a computing platform on which detailed aeropropulsion simulations can be executed in a time compatible with the engine design cycle. In addition, the performance shown by the commodity-based cluster was impressive considering the cost differential between the two computing platforms.

Find out more about the Aeroshark cluster. (http://accl.grc.nasa.gov/aeroshark/)

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